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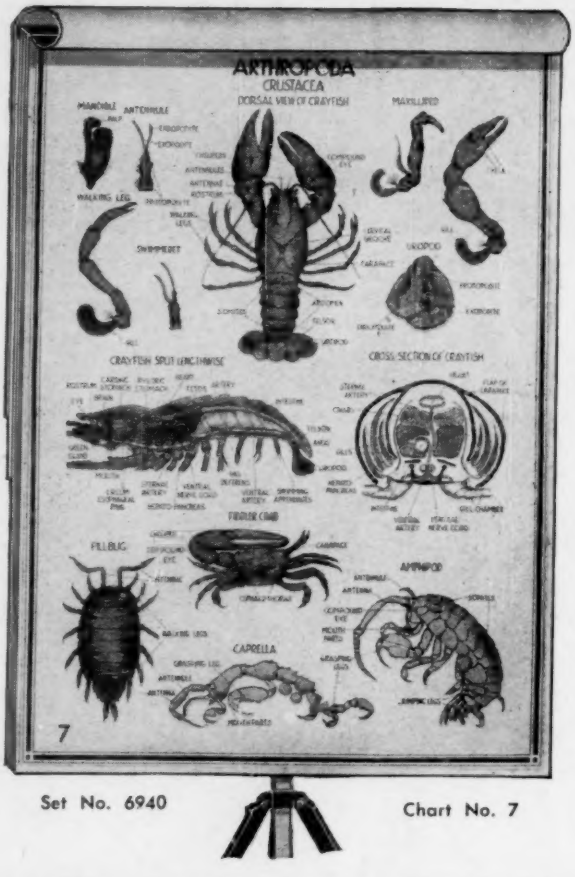

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The American Biology Teacher

Vol. 14 APRIL, 1952 No. 4

How the Teacher's Literature Files Can Serve the Students in Laboratory and Classroom Work*

MARTIN L. GRANT

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The Situation

One aspect of teaching that has continuously interested me is the type of response a student receives when something stimulates him to ask a question. The student's motivation may be, to take a cynical attitude, merely a desire to show he is paying attention, a wish to kill time (meaning the classroom procedure is boring him), an interest in attracting attention to himself, or a hope of staving off other questions from the teacher. Such students, however, are easily spotted and present no real problem. The majority of students' questions are legitimate outgrowths of curiosity, aroused by something associated directly or indirectly with the subject being studied.

The teacher has a responsibility here that occasionally is not realized. Sometimes his answer is "I don't know." and the subject is dropped. His students soon learn to recognize him for what he is. Many more teachers, though, make a valiant effort to see that the question gets some more effective type of response.

There are several ways in which questions can be answered. One is by direct student observation, but this is largely confined to laboratory and field work. Another is by an appeal to logic: quite often the teacher can, by leading questions, help the student figure out an answer himself. These are certainly the most desirable ways, but all too frequently the question goes beyond the possible range of experience of the pupil. The teacher may then either furnish the answer directly, or may, and often this is preferable, help the student to look up the answer himself.

The teacher may very reasonably say, "I don't know," but that, in turn, might

* Presented at the annual convention of The National Association of Biology Teachers, Philadelphia, December 29, 1951.

mean one of three things: 1) "I don't know, and I don't believe anyone knows." This interpretation requires a considerable range of knowledge and experience on the part of the teacher, but, such being the case, is justifiable as a tentative answer. 2) "I don't know, but I'm sure someone does, so we can look it up." 3) The teacher doesn't know which of the above alternatives is the more correct, and thus he is certain to learn himself in the process of finding out.

What is the teacher's and the pupil's usual procedure in looking up answers? The wish to pursue a point to a satisfactory solution is general, but often facilities are inadequate. Since school libraries may be insufficiently complete, most teachers tend to collect literature of various sorts. Several types of such materials may be indicated, grouped under five main heads: 1) books, 2) periodicals, 3) pamphlets and reprints, 4) bibliographies, and 5) clippings.

Types of Materials

1. Books. After twenty-five years of teaching, mostly at the college level, with an initial salary of $600 a year, I have accumulated some 2000 bound volumes, the great majority being reference books. For only an estimated ten per cent has it been necessary to pay the retail price. (Most of what is to immediately follow covers the other types of literature also.) There are many governmental and private agencies which will furnish free to teachers materials that are also sold to the general public. Bent's *Life Histories of North American Birds*, Hassall's *Index-Catalogue of Medical and Veterinary Zoology*, and many of the government-sponsored state botanical surveys are examples which represent the ultimate authorities in their respective fields.

Then there are the book companies (Union Library, Dover, etc.) which make a specialty of distribution of publishers' remainders at half price or less. The full reprint of Audubon's 500 bird paintings was secured in this manner for $4.00. Also, big libraries will withdraw books and dispose of them very cheaply. I know one large reference library which discards, at one-fifth of their original cost, all its books as new editions appear. I was pleased to find that if the library had secured the book free of charge, as it often had, that meant that the book would be given away. Second-hand book stores are profitable sources: Eaton's two-volume *Birds of New York*, with the Fuertes plates, cost me $3.00 at one store, and I picked up for eighty cents a botanical work of which I have been able to find only three other copies in this country.

2. Periodicals. Most teachers subscribe to several professional publications, but do not bother to save them. Here again there are large numbers of trade magazines, house organs, government journals, etc., which teachers can secure for the asking, most of which contain a minimum of propaganda and embody the most recent research developments. A teacher can also persuade his friends to save their magazines instead of throwing them away. Almost every issue of Life, Saturday Evening Post, Collier's, Holiday, etc., contains at least one article of considerable interest in science classes. If a teacher is satisfied to receive magazines a few months old, an almost unlimited source is the local paper drives, so frequently conducted by Boy Scouts, High Schools, Sunday Schools, etc. At our most recent drive I told the students (it was in another school) that if they would allow me to pick out what I wished I would gladly pay them twice what they would receive for them as old paper. Their cooperation was amazing, and for $5.00 there were secured over 300 pounds of such

magazines as National Geographic, Science Illustrated, Popular Science, and Scientific American. If a waste-paper dealer is approached directly similar arrangements can be made. As an example of how easy it is to innocently start a bulky hobby, I began saving a few years ago one complete issue of every periodical I could find: the collection now totals 3500 titles.

3. Pamphlets and Reprints. The sources here are, literally, unlimited. The agencies which are glad to get teachers' names on their mailing lists are legion. Authors, particularly of short scientific papers, will usually send a copy on request, especially if the writer is willing to reciprocate.

Many types of professional periodicals seem to be more useful if they are separated into the individual articles, which can then be filed with the pamphlets by subject. One can secure, by subscription if necessary, two copies of many journals with this idea in mind. In the long run, it is cheaper than writing for reprints. I keep a periodical index for recording what issues have been treated in this way, and also what reprints have been received. The same list covers serial pamphlets such as numbered museum and government publications.

The filing of pamphlets and reprints presents a problem that is likely to be solved in an individual manner. For convenience in handling, all such items may be trimmed, when possible, down to a standard $9 \times 6''$ size. One of the simplest and cheapest storage methods is to use expanding vertical file-pockets (cost eight cents apiece), stood on end on bookshelves, with a gummed label pasted on the outside. Letter-file boxes are more expensive. Since some pamphlets could be put under several headings, this may be accommodated by securing more than one copy, or by referring to the subject bibliography where cross-referencing is easy, or by putting into each folder a pamphlet-size stiff card with the names and locations of other papers on the same subject.

Materials that are used frequently had best be provided with stiff covers, e.g., the Library Bureau Pamphlet Binders. A simpler and cheaper cover can be hand-made from tag-board or an ordinary manila folder, with the reprint stapled in.

4. Bibliographies. There are, of course, numerous published lists, but ultimately I think the teacher will arrive, as all libraries have, at a $3 \times 5''$ catalogue. My own method is illustrated in the example on the next page.

The standardized form is used consistently. On the first line (or more, if necessary) is the title, then a line is skipped, then the author and date, another blank line, then the place of publication, a third blank, and finally a short statement of the contents. If the item were a book, the publication line might read:

N.Y.:Jackson Press. x,328pp.,17pl., 22figs. Cloth,23.5cm. $3.50

Experience has shown that the author is more frequently used as a finding-device than the title, so if I were beginning anew, I would reverse the position of the first two lines, but, since the cited form has been used already on over a third of a million sheets, it is too late to change.

Key words are underlined for filing purposes. Other data are often added, such as school-library call-numbers, citations of abstracts and reviews, and, most important, whether the paper is in my own library. Much of this is done with rubber stamps.

Instead of using cards, this typing of citations for the bibliography is done on ordinary paper (20 lb. weight), thus reducing the bulk of the index by 70%. These thin sheets are not as durable, to

The distribution of reptiles in Iowa

Guthrie, Joseph E. **1920 (1921)**

Iowa Acad. Sci.Proc.27:32-87,pl.2-10,fig.1-30.

A checklist of species of lizards, snakes, and turtles, with keys, descriptions, photographs, maps showing all records by counties, and ecological notes.

be sure, but none have yet worn sufficiently to be retyped. An even greater advantage of the thin paper is that four or five legible carbon copies can be made at the same time, and filed as cross-references. The original goes into an author index, and the carbons into subject, taxonomic, and geographic files.

5. Clippings. This designation includes all material from newspapers and popular magazines, and all small (in size) and short (in length) items that, because of anonymous authorship or ephemeral importance, do not warrant being recorded in a bibliography. Pictures especially are included. Also, duplicate copies of inexpensive or outdated books are often torn up for this picture supply.

If large, the items are folded down to a standard $11 \times 8\frac{1}{2}''$ size. Most items that are $3 \times 5''$ or less in area are put directly into the subject bibliography file where they are easily handled. Slightly larger items, up to about $4 \times 6''$ are pasted on $11 \times 8\frac{1}{2}''$ sheets, usually with several clippings on one page. In removing articles from newspapers and magazines care can be used to cut them just the right size, ignoring the irrelevant marginal material, and thus cutting the amount of pasting down to a minimum. An office trimming-board does the work much more efficiently than scissors, as a dozen sheets may be cut at once. For magazines that are stapled at the edges, as in Collier's, the desired pages can be easily torn out, several months issues at a time, and the torn edges of the whole pile trimmed almost instantaneously with a power paper-cutter at a printing shop. For magazines that are stapled a short distance in from the edge, as was Science Illustrated, the staples should be removed first, or, if only a few pages are desired, they can be scored with a razor blade (preferably in a holder) and jerked loose. The pages of Time Magazine are slightly over eleven inches high, but, in bulk, are easily reduced in size with the power paper-cutter. Life Magazine articles are folded once, making them slightly undersize, $10\frac{1}{4} \times 8\frac{1}{2}''$. These simple techniques,

followed en masse, take most of the labor and tedium out of the process of collecting clippings.

Storing them, though, is another problem, and, like pamphlet-hoarding, is an individual matter. The most common method is to put them into $11 \times 8\frac{1}{2}''$ manila folders in a standard office file. For many years I three-punched them and kept them in standard notebook-binders, but when I had accumulated over 150 notebooks this way the cost of binders appeared to become prohibitive, and I now tend to fall back on the same type of expanding file-pockets as described above under pamphlets, which are similarly stood on end on bookshelves. Inasmuch as the clipping collection now approaches 100,000 sheets, this cheaper solution has not been regretted. The punching, however, is being continued, which makes it convenient to put any material into binders as occasion demands. Standard letter-file boxes can also be used.

Arranging the clippings, and keeping them in order, is managed by writing in the upper right-hand corner a code number based on an expansion of the Dewey decimal system, as used by most libraries. In practice, the clippings are first sorted into about a hundred general subdivisions, such as: scientific method, plant physiology, ferns, and mammals, and then, as each group is subdivided, the first several digits of the code number may be omitted. For example, each family of mammals, and each order of insects, has its own code number, with the genera and families, respectively, being arranged alphabetically, as are the species, and as are also the families of flowering plants. These minutiae of subdivision obviously would not be needed until a collection became exceedingly large.

The fate of most of the periodicals collected by the methods described above is that of furnishing clippings and articles for this collection. If the teacher lets the students know he is collecting periodicals as sources of clippings, the voluntary cooperation that is certain to result will quite possibly provide all that any one instructor could handle in his spare time.

Obviously all this takes some time. A colleague recently told me that he had been impressed by the number of uses I had found for this clipping collection, and he began putting aside items he removed from magazines as he read them, but the pile became rather large, he claimed he never could find time to sort them out, and then, since he couldn't find anything in it as the pile was, he soon threw it all away. I use an assembly-line technique, doing all the tearing at once, trimming them in masses, waiting until a stack two feet high has accumulated, then punching them as a unit, and sorting them out wholesale. Since literature continually appears, one is never up to date, and I always have on hand large amounts of unarranged material. If the teacher has other interests, as the author does, (e.g., art, religion, philosophy, geography, and humor), pertinent materials in these fields can be removed at the same time. All the sheets are rubberstamped with the name of the magazine and the date.

One might add that many types of actual specimens can be mechanically handled the same way as the clippings. This applies to undersized herbarium sheets, flat bird mounts (wings, tail, feet, and beak taped on to an $11 \times 8\frac{1}{2}''$ card), etc. These can be protected by transparent plastic pocket-like covers (protective visible envelopes or transparent sheet protectors) and can also be put into either notebook-binders or file-folders. I showed some of these bird mounts recently to Roger T. Peterson, the bird artist, whose comment was that

they would be better for his painting purposes than mounted specimens, since they could be handled more easily and inspected more closely. Obviously, the same features would apply to their use by beginning students. Also, standard $8 \times 10''$ photographic enlargements (and the smaller $3 \times 4''$ size, mounted in fours on $11 \times 8\frac{1}{2}''$ paper) can be mixed in with a clipping collection, as can mounted stamps (Colombian orchids, Bornean mammals) and coins (Guatemalan trogons, Irish animals) that have a biological theme, and numerous other things.

Method of Use of the Materials

Certainly, in teaching biology courses, actual living things, studied in the field or in the laboratory, are the most fertile stimulants to learning. Personally, as a plant taxonomist and animal ecologist, I am interested more in field work than in the other kinds of teaching situations, but obviously not all subjects, nor all seasons, nor all class schedules, lend themselves readily to this type of experience. Next best are specimens of the organisms and their parts, as prepared by the taxidermist, herbarium worker, or histological technician. The present paper is suggesting the use of literature materials not in place of the above, but, first, as supplementary materials, second, as seasonal partial replacements, especially in winter, third, as broadening influences to make it possible to cover in a general way a much larger field (e.g., taxonomically or geographically) than would otherwise be possible, and, fourth, as a time saver. For example, a few types may be studied directly in the field or laboratory, and then a wide range of related forms covered rapidly by means of pictures. There are obviously many other types of visual aids (Riker mounts, plastic embeddings, lantern slides, Kodachromes, motion-pictures, charts, models, etc.), but, in general, only printed material is being discussed here.

Services to which these literature materials can be put include: 1) laboratory and demonstration accessories, 2) inspection in the classroom, 3) opaque projection, 4) bulletin-board displays, 5) permanent wall mountings, 6) individual assignments, and 7) casual inquiries.

1. Laboratory and demonstration accessories. At a demonstration, when a student is looking at some totally-unfamiliar material with a microscope, it is an excellent orientation device to have a picture, preferably a colored labelled photomicrograph, of the same or similar material, on the table beside the microscope, where a comparison can be readily made. If drawings are to be made by the student, I would recommend that the picture be just different enough so that the instructor could readily see whether the student's sketch as turned in represents the contents of the microscope field or is a copy of the picture furnished. If a macroscopic object, such as a tree cross-section or a dogfish, is to be studied, it is much easier to put labels on an adjacent picture than on the specimen. Also, clippings representing short write-ups or pictures of additional non-available materials can be interspersed among actual objects in connection with the type of demonstration set-up in which students wander around for a half-hour or so among the materials.

2. Inspection in the classroom. Here, of course, wall-charts are more satisfactory, but always limited as to content, and it is very easy for a teacher to impress a point by simply holding up a moderate-sized picture before a medium-sized class. For example, in a discussion of "flight," much time can be saved by simple pictures of a flying squirrel, flying fish, etc., to supplement the actual bird and insect specimens used. I keep available systematically arranged pictures of thousands of animals for just such purposes.

3. Opaque projection. Except for the

accompanying darkness, I find this one of the most effective and versatile of classroom procedures. While our Science Department has a few hundred lantern-slides and Kodachromes, we have thousands of pictures. As a stimulant to introduce a discussion, a picture outclasses a spoken question. Series of pictures can be kept together for frequently-used programs. This may mean duplication of pictures, but, as an example, I have for years regularly torn up an average of four copies of each issue of Life Magazine. The newer opaque projectors can readily handle these single sheets of thin paper, though, if desired, much-used ones can be mounted on cards.

4. Bulletin-board displays. This medium is abundantly used, particularly at the lower grade levels. Ordinarily the teacher sees something in the Sunday paper, puts it up on the board, and, after a week or so, takes it down and throws it away, or, if he does save it, it can't be found the next year. Why not a permanent organized collection of such things? While local pertinence and contemporaneity are important as motivation, most ideas in biology, especially pictures, are relatively eternal. Not that the same materials need always be used with each new class, for a medium-sized collection admits of wide variety for displays.

5. Permanent wall mountings. If extra wall-space is available, the more frequently used items can be left up indefinitely, or kept on panels or screens.

6. Individual assignments. In connection with term papers, individual reports, and special projects, while it is important for students to learn how to use the library, and search out materials on their own, the teacher can often supplement such sources by his own files in a simple and efficient way. If a student comes in for material on, say, tuberculosis, he can be handed simple items which might take him weeks to find and accumulate, even though he could, if desired, secure most of it gratis.

7. Casual inquiries. I will give two examples. A high school boy came in with a box: "My brother sent me these butterflies and moths from New Guinea. Just what are their names?" Obviously this would go beyond the range of most teachers' libraries, and accordingly the suggested project was never completed, but we did manage to find the names of many of them, and the genera of most of the others. As a result (I think), the boy eventually entered biology as a profession. Also, a former student writes from Venezuela, "I am teaching sixth grade biology, among other things, but can find no reference books on local plants and animals to help me." She was sent about twenty references, with publication addresses and prices. These two are extremes, to be sure, and the local requests are more easily handled.

All teachers and all sources have obvious limitations, but when a student complains, "I can't understand the uniform-field theory," my answer, "I can't either," is made more meaningful as I show him an article on the subject by Einstein, well-sprinkled with unfathomable (to me) equations. Or, when a student requests a full explanation of osmosis, I let him glance at Broyer's mathematical treatment in the Botanical Review.

Discussion

How much time might a teacher give to collecting and preparing this material? Some people, by temperament, find any type of systematic behavior obnoxious. Some such are, strangely enough, in the field of science teaching, and the answer for them is probably "none." There is a school of thought believing that the saving of all types of

"things" is much more trouble than it is worth. "You can't take it with you." For most people, though, a small beginning is the reasonable answer, with the amount of use made of the material, and the amount of innate curiosity in the teacher, serving as limiting factors.

Should the literature collection be considered the property of the school or of the teacher? Almost all such collections represent the work of an individual, done frequently on his own time after hours. If it were turned over to a group of less interested individuals, the collection, for lack of responsibility, may deteriorate.

Most United States high school biology teachers are lone wolves, being the only such in their school, so the question may be academic. However, with cooperation from the school administration, and perhaps from the librarian, if any, much can be done to make the collection a permanent feature of the institution, by the school's procurement of materials, storage files, shelving, etc. School secretaries and students often will help. In my own case, even though I have over twice as much space as most teachers, I have been forced, by lack of room, to keep the less-used portion of the materials at home.

Should the students be allowed to browse indiscriminately through the collection? Yes, but not as a general privilege. I feel the collection survives better if each and every request to use it is granted as a special favor. Some supervision will always be necessary until the student becomes oriented and responsibility is demonstrated.

To many other questions I would not attempt to give positive answers, as situations are likely to be heavily influenced by personal and local factors.

SUMMARY

Methods of treating 1) books, 2) periodicals, 3) pamphlets and reprints, 4) bibliographies, and 5) clippings are discussed, with emphasis on inexpensive sources, and rapid and efficient standardized methods of procuring, preparing, arranging, and storing. Services to which these literature materials can be put include: 1) laboratory and demonstration accessories, 2) inspection in the classroom, 3) opaque projection, 4) bulletin-board displays, 5) permanent wall mountings, 6) individual assignments, and 7) casual inquiries.

Bibliography on Narcotics

No specific bibliography on narcotics is generally available to teachers. The list of references which follows is not complete but it is a beginning. Some courses of study have a unit or units on alcohol and tobacco—for example, the course of study in Science of the Chicago Board of Education. Many teachers in considering narcotics think only of the dangerous habit-forming drugs, derivatives of opium and cocaine, forgetting alcohol and tobacco, as well as the alkaloids of the nightshades. These latter, except in conjunction with opiates are no problem and shall not be considered here. Although Marihuana (*Cannabis sativa*) is probably not habit-forming, it is mentioned here because it is the first step toward addiction. *Mescal* or peyote used by the Southwestern Indians probably is not habit-forming or even worth considering especially as its use is religious in significance. This entire peyote subject is so controversial as to permit no rational conclusion. But with alcohol, cocaine, opiates and tobacco there can be no reasonable doubts of their social, and physiological effects. The

problems concern those engaged in Crime Control, Juvenile Problems, Public Health, Social Work, and even historians and writers in the field of social studies. (See Barnes, H. E., *Society in Transition*, pp. 819–824, Alcoholism, and pp. 803–819, Narcotics.) The United Nations is also working in this area. (See their Bulletin of Narcotics, V. 2, #4 is especially valuable. United Nations Department of Social Affairs, Lake Success, New York.)

Some temperance and religious groups have not distinguished themselves by a realistic nor scientific approach. Such sources are not included.

Audio-Visual Aids Committee,
JAMES M. SANDERS, *Chairman,*
Chicago Teachers College,
Chicago, Illinois

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Alcoholism—p. 17, cited from *California Medicine*, January, 1950.

TOBACCO

Gehman, J. M.—1943
Smoke Over America—Roycrofters, East Aurora, New York.

Steinhaus, A. H., and Florence M. Grunderman—1941
Tobacco and Health—Association Press, New York, New York, $0.35.

FILMS

Young America Films, Inc., 18 East 41st Street, New York 17, New York
The Story of a Teen-Age Drug Addict—16 mm., sound, black and white, 18 minutes, high school, college, adult. Rent.

Division of Visual Education, Chicago Public Schools, Chicago, Illinois
Films—available for teachers by request.

Encyclopaedia Britannica
Film on Narcotics.

BIOLOGY IN THE NEWS

Which Diets Are Dangerous by Llewellyn Miller, *Cosmopolitan*, March 1952, pp. 56 & 119–123.

Thinking of going on a diet? Read these facts about common food fads and their effects before you start.

He Turned His Back on a Million Dollars by Roul Tunley, *American Mag.*, March 1952, pp. 21 & 132–136.

An interesting glimpse of the life of Dr. Selman A. Waksman, the discoverer of streptomycin. A man who is too busy discovering ways to help man to be bothered with caring for a fortune.

Modern Whaling, *Life*, March 24, 1952, pp. 56–61.

A picture description of hunting and reducing the oil of the largest animals the world has ever seen. You will want page 61 for your permanent picture file.

The Dog Business Is Here to Stay by Dickson Hartwell, *Coronet*, March 1952, pp. 104–108.

Does your dog cost practically nothing to maintain? This interesting article estimates that the costs of feeding, training and grooming dogs runs into the millions of dollars annually.

You Can Save a Life This Way by Ann pringle, *Woman's Home Companion*, March 1952, p. 14.

The back pressure–arm lift method of artificial respiration is well illustrated and described. Just the thing for those students changing over from the Schaefer method.

NABT PRESIDENT RECEIVES GRANT

Harvey E. Stork, president of NABT and chairman of the Department of Botany at Carleton College, Northfield, Minnesota, has received grants from Sigma Xi-Resa (Research Society of America) and from the Hill Family Foundation of St. Paul, to continue his work on the wood anatomy of tropical American trees. On three expeditions to Costa Rica, Dr. Stork has collected 2300 specimens for the Carleton herbarium. Among these were 160 trees from which wood samples were collected. The preparation of microslides and photomicrographs of the samples is in the process of completion, and they will aid in the classification of the species.

Dr. and Mrs. Stork will spend about 14 weeks in Costa Rica, and later they will go to the University of California (Berkeley) to prepare and study the collection. Dr. Stork is author of the books, *Studies in Plant Life* and *Evolution of Plants*.

THE FIRST TWO ISSUES of the new Welch *Biology and General Science Digest* have arrived at the editor's desk. The digest is not a house organ nor just an advertising sheet. It is an attractive magazine, with lots of information in it.

In the February issue, for example, pages 1 to 16 are occupied by a series of articles and notes on diatoms, eyes, ergot poisoning, public health, obesity, shade trees, algae and several other biological topics. Pages 17 to 30 carry information about Welch products useful to biology and general science teachers. The W. M. Welch Scientific Company is one of our faithful advertisers. We welcome The Welch *Biology and General Science Digest* and urge all readers of ABT to write the Welch Company for information concerning it. The Welch ad appears on the inside front cover.

The Treatment of Conservation in Some Representative General College Texts of the Past Two Decades

CHARLES E. PACKARD
Randolph-Macon College, Ashland, Virginia

What has been the trend in emphasis on the important topic of biological resource use and husbandry in college teaching of the immediate past? What is the outlook for the future? These are questions worth considering in a day when considerable effort is being made to make our nation more aware of its conservation problems. The following examination shows how certain authors of college texts have treated the matter from 1930 to date.

Animal Biologies of the Thirties

1931. *Animal Biology*. Guyer, M. F., Harper, 744 pp.

Biological conservation [1] and Ecology, a related topic, are both indexed, the latter word being in the glossary. Chapter 1, *The World of Life*, 14 pp., has two paragraphs entitled "Conservation, Public Support of Economic Measures" with other portions bearing on the topic. Page 659 of chapter 28, *Zoology Today*, has a paragraph on "Ecology."

1933. *Animal Biology*. Wolcott, R. H., McGraw-Hill, 615 pp.

Conservation is not indexed but ecology is. Chapter 67, pp. 477–486, *Animal Organisms in Relation to Their Environment*, has the sub-title *Ecology*. Chapter 69, pp. 493–498, treats animal associations. Chapter 70 is on health. The glossary defines neither term. Broadly ecology implies the living organism in relation to all factors impinging upon and influencing it, conservation the intelligent use of living resources, looking especially toward their perpetuation. Humans and their welfare enter into this picture. Many divisions of biology combine their contributions, therefore, into the interrelated whole that converges upon conservation.

1939. *An Introduction to Animal Biology*. Parker, J. B. & J. J. Clarke, C. V. Mosby, 503 pp.

This is primarily a "types" text. Ecology is defined on p. 17. Conservation is not in the table of contents, index, nor glossary.

Plant Biologies of the Forties

1943. *Plant Biology*. Weatherwax, P., W. B. Saunders, 455 pp.

Ecology is in both glossary and index, conservation in neither. The table of contents gives no indication of treating resources and their use.

1947. *The Essentials of Plant Biology*. Kern, F. D., Harper, 440 pp.

Ecology is defined, p. 5, and discussed under *Plant Associations*, pp. 267–276. There are three fine photographs from the U. S. Forest Service, one from the National Park Service. There is a good chapter, 12, of 20 pages, on plant improvement and breeding. Conservation of plant life is not listed.

General Biologies of the Thirties

1930. *Foundations of Biology*. Woodruff, L. L., Macmillan, 4th ed., 501 pp. (recently completely revised).

Ecology is indexed, conservation not. Likewise for Glossary. Chapter 23, on adaptation, has 28 pages. Chapter 25, *Biology and Human Welfare*, pp. 372–405, has a section 2½ pages long on *Conservation of Natural Resources*, with one figure on soil erosion from U. S. Forest Service. Section D, *Constructive Biology*, pp. 405–410, discusses biological research problems.

[1] Hereafter when used "conservation" will signify its biological meaning.

1937. *Biology, the Story of Living Things.* Hunter, Walter & Hunter, American Book Co., 670 pp.

Chapter 25, *Conservation and Its Meaning*, pp. 589–607, is excellent. Four fine references, two by Hornaday, one each by Pack and Rowan, are listed. Both conservation and ecology have several citations in the index. The first section of the book, *Natural History*, has three fine chapters entitled, *The Stage Setting*, *The Biological Conquest of the World*, and *The Interdependence of Living Things—The Web of Life*, all related to conservation and ecology. The final section, *Man as a Conqueror*, of which the conservation chapter is the second, also has *Man's Conquest of Nature*, *Man's Fight for Survival*, and *The Next Million Years*, all bearing upon the topic. In the latter about a page deals with *Human Betterment*. This text sems to be a revision of the authors' earlier *College Biology*. Is it possible that it reflects the influence of Dr. V. E. Shelford, one of our leading ecologists?

1937. *General Biology.* Kenoyer, L. A. & H. N. Goddard, Harper, 630 pp.

Conservation is discussed in a paragraph on p. 525, *Ecological Influence of Man*. This is the concluding section of chapter 26, pp. 502–525, *The Organism and the Environment*. The appendix lists 13 very good references on adaptation, ecology, and the environment as it affects animals and plants. Chapter 27, pp. 526–542, treats *The Biology of Man*. Ecology is defined in the glossary, conservation is not. Both terms are indexed.

1939. *Fundamentals of Biology, Animal and Plant.* Beaver, W. C., C. V. Mosby, 896 pp.

There are six listings indexed for ecology, none for conservation. Chapter 32, pp. 622–636, *Plant Ecology and Plant Geography*, is a very good summary with 14 excellent references. Ecology is in the glossary. Chapter 21, pp. 436–467, with 31 titles, covers the ecology of animals very acceptably. A revision of this text is appearing.

General Biologies of the Forties

1943. *Biology: The Science of Life.* MacDougall, Mary S. & R. W. Hegner, McGraw-Hill, 963 pp.

Chapter 49, pp. 834–854, is in two sections: *Conservation of Our Natural Resources*, pp. 834–846; *Conservation of Man*, pp. 846–854. In the former are 31 photo-reprints, 4 from the U. S. Forest Service, 3 from the Wild Flower Preservation Society. In the second part there is one reprint from *The Atlanta Journal*. The content here relates largely to communicable disease and public health.

Chapter 46, pp. 756–779, covers adaptations. Chapter 48, pp. 805–833, deals with *Biology and Human Welfare*. One section discusses the *Relation of Plants to Man*, the other, animals to man. Chapter 6, 18 pages, treats interdependence and environments, is therefore ecological. Conservation and ecology are indexed, the latter only being in the glossary.

1944. *College Biology.* Wellhouse, W. H. & G. O. Hendrickson, F. S. Crofts, 391 pp.

Chapter 30, *Conservation*, pp. 350–360, has a reference list of 6 titles. Conservation is indexed, ecology is not, a rather uncommon reversal of customary procedure. *Natural Resources* is an indexed topic, also unusual, with the text material included in the conservation chapter.

1946. *Life Science.* deLaubenfels, M. W., Prentice-Hall, 340 pp.

Soil conservation is indexed and briefly discussed. *Ecology*, chapter U, of this text which strives to be different, pp. 244–254, has four references.

1944. *Elements of Biology*, 461 pp.

1947. *General Biology*, 718 pp., both by Strausbaugh, P. D. & B. R. Weimer, John Wiley.

Both index ecology and conservation. In the earlier book *Conservation* is part of chapter 15, *Plants and Animals in Their Environment*, pp. 381–408. Chapter 14, pp. 362–380, is on economic relations of man, plants and other animals. Chapter 13, pp. 327–361, discusses *Biology and Human Health* very well.

Chapter 17, pp. 581–621, *How Are Living Organisms Related to Their Environment? Ecology*, of the later text, is especially good. There are photo-reprints here from the

National Zoological Park, Soil Conservation Service, Fish & Wildlife Service, American Museum of Natural History. The texts duplicate to some extent.

1947. *General Biology*. Mavor, J. W., Macmillan, 986 pp.

Ecology, indexed, is defined on p. 11. *Conservation of Natural Resources*, topic B, a paragraph of 13 lines, is found under *Biology in the Service of Man*. Remaining parts are *Agriculture, Fisheries, Medicine, Public Health and Society*, all brief. These four pages form part of Chapter one, *The Scientific Method and Its Application*.

Chapter 17, pp. 353–366, deals with the economic importance of plants. Chapter 9, on bacteria, pp. 220–252, is excellent and has much material on transmission of infectious diseases. Chapter 39, *Animals and Plants in Relation to Their Environment*, pp. 750–808, also good, deals with ecology. It comes under the broader title of *The Organic World and Its Evolution*.

A Brief Biology, by the same author and publisher, 1949, of 427 pages, follows much the same treatment on a reduced scale, having 15 pages on ecology.

1949. *The World of Life*. Pauli, W. F., Houghton Mifflin, 653 pp.

This striking text has material on soil conservation, pp. 242–245. Ecology is indexed and defined in the glossary.

1949. *Biology and Its Relation to Mankind*. Winchester, A. M., D. Van Nostrand, 777 pp.

The index reference is to ecology which is defined on p. 10. The glossary also defines it but conservation does not appear. Disease and the importance of microbiology are well done. The topic, therefore, relates to human resources.

1950

This year saw a number of new productions of worth and interest, also some thorough revisions.

College Biology. Etkin, W., Thomas Y. Crowell, 806 pp.

The glossary-index defines ecology and mentions "conservation of the topsoil." Chapter 19, *The Organic Community*, pp. 423–446, is ecological and nicely done. Chapter 20 is on *Parasitism and Disease*. All the illustrations and photographs seem to be original. Functional principles stand out.

Biology, Its Human Implications. Hardin, G., W. H. Freeman, 635 pp.

Ecology and conservation are both indexed. Chapter 34 is devoted to *The Conservation of Natural Resources*, pp. 537–559. There are 11 photo-reproductions from the U. S. Soil Conservation Service, one from U. S. Forest Service. *Ecology*, with its index reference to pp. 528–621, is here broadened to include chapter 33, *The Significance of Decay*, the conservation chapter above, and 6 succeeding ones on aspects of evolution to the end of the book, very interesting material. The author is unconventional in this treatment. Ecology is usually not so general in scope.

General Biology. Moment, G. B., Appleton-Century-Crofts, 680 pp.

Both ecology and conservation are indexed, with the former defined in a glossary. Chapter 10 is in two sections, *The Web of Life—Ecology*, pp. 201–217, and *Bacteria and Diseases*, pp. 217–230. Some of the fine references, often included in such lists, are: Gabrielson's *Wildlife Conservation; Principles of Animal Ecology*, by Allee *et al.*; Darwin's *Vegetable Mould;* Malthus on *Population; Deserts on the March* by Sears. Two photo half-page reprints from the Soil Conservation Service are included in this very attractive modernized version.

Biology, The Human Approach. Villee, C., W. B. Saunders, 580 pp.

This text continues the fashion of the era with its stress on man. *Ecology*, chapter 30, pp. 547–555, is largely evolution and adaptation. One short section of three paragraphs is on ecology as such, with a like number given to *Biologic Interactions*. There are 5 references on ecology and adaptation. Chapter 22, pp. 385–410, is titled *Micro-organisms and Infectious Disease*.

1934. *Elements of Modern Biology.* PLUNKETT, C. R., Henry Holt, 540 pp.

1951. *Principles of Modern Biology.* MARSLAND, D., a revision of the preceding.

The earlier book does not index either term but "ecological" is defined in its glossary. The later one indexes ecology and defines it in the glosary but omits conservation. *Ecology and Evolution*, chapter 28, has 23 pages with 4 references.

This survey shows, in summary, that although authors of college texts recognize the demand for a discussion of the interrelations of organisms to each other and their response to environmental factors with their dependence on the same they do not put into their books very much that is strictly conservation teaching. The emphasis is more on theoretical aspects than on what is often termed applied biology.

It has frequently been true that the institution of higher learning has had a powerful effect on what is taught in the lower preparatory levels. This seeming lack of consciousness of the need for presenting conservation of natural biological resources to large segments of our future citizens who would benefit much by it is regrettable. Only the exceptional college textbook author is regardful of the importance of conservation. Morphology continues to occupy a large share of attention.

BOOK REVIEWS

CORRELL, DONOVAN STEWART. *Native Orchids of North America.* The Chronica Botanica Co., Waltham, Mass.; Stechert-Hafner, Inc., New York City. xv + 399 pp. illus. 1950. $7.50.

This volume is the only comprehensive flora of the orchids of all of North America north of Mexico. It has the twofold value of being technical and of being sufficiently clear to be popular. The illustrations are characterized by artistic excellence, and still they show the exactness of detail that is necessary for identification.

The arrangement of the text is uniform throughout. There is a key to the genera. Following the description of each genus is a key to the species. The keys, each arranged with pairs of contrasting statements, are artificial; i.e., they are "constructed for utility and not for the purpose of showing relationship." The meanings of the technical names of the orchids are given to encourage the wide use of more exact terms, as has become the custom with such names as *Rhododendron* and *Chrysanthemum*. Following the description of each genus and species there are general remarks that deal with the history of its collection, the nature of the habitat, the time of flowering of the orchids, and the general observations by which one learns to know the plants in the field. Within the United States the locations of the orchids are given in terms of counties as well as states. The "method of culture" for each species is a definite contribution to horticulture; this information also discourages the removal of orchids that are seldom transplanted successfully.

The author points out that, of nearly two hundred species and variants in the orchid flora, the greatest number occurs in the mesophytic area of eastern United States and Canada and that nearly one hundred ten are found in southeastern United States. The smallest number of species are found in the prairies and great plains of the Mississippi basin. Field study of the orchids should be encouraged by this excellent book. It is a book that one may enjoy browsing through, but more important is the fact that it is destined to become the standard manual of the orchids for the United States.

The orchid flora was written by Dr. Donovan S. Correll, the cultural notes were written by Dr. Edgar T. Wherry and John V. Watkins, and the illustrations were drawn by Mrs. Oakes Ames and Gordon W. Dillon.

ROBERT C. MCCAFFERTY,
Central High School,
Wadsworth, Ohio

GARDNER, VICTOR R. *Basic Horticulture.* 2nd ed. The Macmillan Co., New York. x + 465 pp. illus. 1951. $4.75.

It has been nine years since the appear-

ance of the first edition of *Basic Horticulture*. The preface remains essentially the same as in the first edition. It is undated and states no reason for the revision. However, upon even a casual examination of its contents, it becomes apparent that the new edition brings us up to date by presenting the newer knowledge of hormones and growth regulators, and weeds and their control, which are topics of much current horticultural interest. Two new chapters dealing with these subjects have been added. In addition, suggested laboratory exercises have been appended, which will greatly enhance the value of the book. The book contains some 25 more pages than the former edition, yet it is smaller, more compact, and in general, a more attractive book.

The author continues to follow the same dynamic approach as in the former edition, that is, the acquaintance of the student with horticultural plants—their structure, physiology and environmental reactions (culture), rather than with an encyclopedic treatment of the numerous varieties of fruits, flowers and ornamentals.

In addition to being a leading text for general courses in horticulture, for which it was primarily intended, *Basic Horticulture* might well be considered as a text or reference for general botany courses with the economic or horticultural slant, and as reference material for courses in plant physiology and high school courses in biology. Due to the readability of the book, it is recommended to the layman for a practical scientific treatment of horticultural plants and their culture for profit and pleasure.

J. A. Trent,
Oklahoma Baptist University, Shawnee, Oklahoma

Prescott, G. W. *Algae of the Western Great Lakes Area*. Cranbrook Institute of Science, Bulletin 31, Bloomfield Hills, Michigan. 946 pp. illus. 1951. $10.50.

This book represents an outstanding contribution to the study of fresh water algae. While the title indicates a comparatively small study area, it actually includes many species outside. Over 1000 algae are described. The introduction covers the geographical features of algae distribution including soil and lake types and the relationships of phytoplankton to lake productivity. Morphological characters are well illustrated. In addition to the systematic account there is a good analytical key to the genera. The various species are illustrated by 136 plates. There is an adequate glossary. Perhaps most outstanding is the bibliography which in itself is of considerable value.

While this is a specialized book and of most value to the student and teacher of fresh water algae or limnology, or to water and sanitary engineers, it might well find its place on the library shelf for the high school biology teacher who wishes the most complete references for those rare but ever curious students.

John P. Harrold,
Senior High School, Midland, Michigan

Eaton, Theodore H., Jr. *Comparative Anatomy of the Vertebrates*. Harper and Brothers, Publishers, New York. viii + 326 pp. illus. 1951. $4.00.

Mr. Eaton has written this text for a one-semester course in comparative anatomy. The book is thorough, although concise, and contains enough material for an introductory course. There are twelve chapters, with the first entitled "The Kinds of Chordates." This chapter contains material on the relationships among the vertebrate groups as shown by their structural and functional evolution and more specifically—the names, appearance, and the ways of life of the animals concerned. The second chapter is about development of chordates in general with specific detail of the embryology of the frog. The following nine chapters deal with the various body systems including: Integument; Skeleton; Muscles; Digestive and Respiratory Systems, and Coelom; Circulatory; Urinary and Genital; Sense Organs; and Nervous System. Chapter twelve, "Panorama," is divided into three sections: first, an historical review of the men who have contributed to the rise of comparative anatomy; second, some of the theories as to the origin of the vertebrates and a brief dis-

cussion of these; and third, an over-all picture or view of the vertebrates with emphasis on the evolutionary aspects of man.

Comparative Anatomy of the Vertebrates contains 332 illustrations on the 316 pages of actual text material. Most of the drawings are well-labeled line drawings either drawn or redrawn by the author and are suited for the text material. Another commendable feature is that the text frequently refers to the illustrations and these figures are usually on the same page as the reference. No glare is produced from the paper and the print is easy to read. Italicized bold-faced type is used for printing important words. Each chapter is divided into subheadings and some of the chapters contain introductory paragraphs. Sixty-nine references comprise the bibliography and the accurate, 19-page index contains italicized page numbers when the item is illustrated on the page. On the inside of the cover of the book is a graphic chart showing the relationship of the vertebrate group from their earliest appearance in the Ordovician Period to the present time.

This book can be recommended for a one-semester course and the author's informal but informative style should appeal to the college student.

Ruth E. Griffith,
University of New Hampshire, Durham, New Hampshire

Fischer, George William. *The Smut Fungi.* Ronald Press Company, New York. vii + 387 pp. 1951. $6.00.

The long and tedious task of searching through journals, books, and periodicals, for available literature on the smut fungi is eliminated with the publication of this book. Here teachers and research workers in this particular field will find listed the literature available on 330 species of smut fungi.

The book is divided into two parts. In part one the available literature is listed alphabetically and chronologically under the following subject-matter guide subdivisions: Control; Culture on Artificial Media; Cytology; Heterothallism and Sex; Hybridization and Genetics; Life History, Parasitism, and Factors Affecting; Longevity of Spores; Miscellaneous Records; Physiologic Specialization; Spore Germination and Factors Affecting; and Varietal Resistance and Susceptibility. The bibliography which makes up the second part of the book lists 3353 articles appearing in scientific papers, bulletins, and books. The author does not claim that all species of smut fungi are represented, this being due primarily to the lack of information about their biology and control at the time the book was being prepared.

A distinct feature of this book is the list of chronologically arranged references under the various subject-matter guide subdivisions. Workers in plant pathology, mycology, agronomy and botany will find this book valuable especially when embarking on a research problem. Subject-matter specialists in other phases of mycology and plant pathology have a pattern which they might well follow in preparing a similar work in their special fields.

Melvin A. Hintz,
South Milwaukee High School, South Milwaukee, Wisconsin

Robinson, F. A. *The Vitamin B Complex.* John Wiley and Sons, New York. xi + 688 pp. 1951. $9.00.

This book reviews all the published literature on the subject of the Vitamin B Complex. It includes an evaluation, selection and re-arrangement of the most important facts. The book indicates the resemblance of the separate vitamins of the complex to each other. There is material not only on their distribution in foodstuffs but their biological effects on plants and animals generally, including the insects and the micro-organisms.

There are methods of assay for analysts; methods of synthesis for pharmaceutical manufacturers; the nature of deficiencies in animals and man for agriculturists and clinicians; and nutrition of micro-organisms for the microbiologists. Extensive literature references are also supplied for specialists in each field. There can be little doubt of the great value the book would have for research workers in the field.

Philip E. Foss,
Hartford Public High School, Hartford, Connecticut

WING, LEONARD W. *Practice of Wildlife Conservation*. John Wiley & Sons, Inc., New York. viii + 412 pp. illus. 1951. $5.50.

Because the reproductive rate of an animal is normally higher than required to maintain a level population, the surplus is taken by disease, predation, failures in food supply, and other mortality factors. Man shares in this surplus by his harvest of game species. And by controlling the environmental factor which limits a population level, man is able sometimes to increase his own share in the harvest.

Dr. Wing's book is an introductory survey of the principles and techniques in this management. Chapter 2 and 3, on the biological basis of management, discuss concepts of ecology that are vital even in a course in general biology. The greater part of the book is concerned with techniques and practices with particular species or animal groups.

Selected references for further reading are suggested at the end of each chapter. The index is unusually complete.

RICHARD F. TRUMP,
Senior High School,
Ames, Iowa

BERRILL, NORMAN JOHN. *The Living Tide*. Dodd, Mead and Company, New York. 256 pp. illus. 1951. $4.00.

This is a fascinating book—a revelation to those who are unaware of the many strange creatures inhabiting the "foaming fringe" of the sea.

Mr. Berrill, a professor of marine zoology at McGill University in Toronto, is a happy combination of scientist and writer who is able to transfer his own enthusiasm to his readers on his collecting trips from the warm waters of the Tortugas to the cold waters of Maine with a side trip to the Pacific Coast.

This is not a textbook of invertebrate biology but rather an intimate story of the lives of the myriad of species found in the tidal zones. At no time do you have the feeling of being crammed with biological facts. Rather, one reads with the desire to see what strange creature he will unfold next. Do you want to know why jellyfish must swim away from the earth toward the sun or what makes a jellyfish, or about the crab that can husk a coconut and crack its shell and who lives in the tops of coconut palms, why sponges stink so, what animal has an optic nerve passing through the liver to reach its third eye, or why the male catfish has to carry fifty or sixty marble-sized eggs in his mouth for two months, how a scallop swims, how Piddocks can bore into cement, that anemones can live for centuries, about the intelligence of the octopus, or the mechanics of the submarine jet-propelled squid. It took me several days before I could get hold of this book to read. My wife and teen age daughter beat me to it and would not let go until they had finished. In addition, both wanted to go to the beach the next day to see what we could find in our Pacific tide pools. I defy anyone to read this book and not be interested in marine life. This book is a must for every scientist and should be in every school library.

CHARLES C. HERBST,
Beverly Hills High School,
Beverly Hills, California

KUMMER, ANNA P. *Weed Seedlings*. The University of Chicago Press, Chicago. xxxiii + 435 pp. illus. 1951. $5.00.

This book commences with a key to the species of 300 nonwoody broad-leafed seedlings of weeds. These weeds are the common ones of the United States and Canada, and they also include those that are "particularly dangerous or noxious." The key uses the characters that are most easily observed, and it has a clear arrangement that leads to a pen sketch for each weed. The sketch, which is of life size, is accompanied by a drawing of a seed leaf and the first, third, and fifth leaf of twice the life size. Qualities that are not obvious in the drawings are included in a description. Finally, the habitat and geographic distribution of each weed is given. The book has a good quality paper back, and it contains an artificial key that is well designed for practical use. The nomenclature is that of Gray (8th ed.).

ROBERT C. MCCAFFERTY,
Central High School,
Wadsworth, Ohio

SINNOTT, EDMUND W., DUNN, L. C., and DOBZHANSKY, TH. *Principles of Genetics.* 4th ed. McGraw-Hill Book Company, Inc., New York. xiv + 505 pp. illus. $5.00.

In this revision of an excellent textbook a third co-author, Professor Dobzhansky, appears for the first time. The extensive rewriting and expansion (25% increase in number of pages) involved many additions, deletions, translocations, inversions, and changes in wording. The new material consists chiefly of three new chapters on population genetics, race formation, and speciation, to replace the single chapter on Genetics and Evolution in the 1939 edition. One of the most noticeable changes is the discussion of human traits (including pictures of some of these) in various chapters.

The illustrations have been improved by the substitution of better figures in certain cases and the increase in their number from 147 to 202. As in previous editions there are selected lists of references at the ends of the chapters and extensive lists of problems for the first 13 of the 18 chapters. A new and valuable feature is the printing, as an Appendix, of an English translation of Mendel's classical paper on peas. This should continue to be a popular handbook for students of genetics, especially for those who are majoring in the biological sciences. Teachers of the biological sciences at all levels will find it a very useful and reliable reference.

EDWARD C. COLIN,
Chicago Teachers College,
Chicago, Illinois

DEMEREC, M. (Editor). *Biology of Drosophila.* John Wiley & Sons, Inc., New York. x + 632 pp. illus. 1950. $10.00.

The aims of this book are "to supply a comprehensive and detailed treatment of the anatomy, histology, and development of a single species of insect that had become an important laboratory animal; to present its basic norm as a standard for the analysis of experimentally induced genetic variations and for other physiological studies; to provide detailed descriptions that should be of considerable value in comparative morphological and embryological studies of other invertebrates; and to give a brief summary of the methods used for collecting material in the field and culturing it in the laboratory."

There are seven chapters by as many authors: 1. Normal Spermatogenesis by Kenneth W. Cooper, 2. Early Embryology by B. P. Sonnenblick, 3. Histogenesis, Organogenesis, and Differentiation in the Embryo by D. F. Poulson, 4. Postembryonic Development by Dietrich Bodenstein, 5. External Morphology of the Adult by G. F. Ferris, 6. Internal Anatomy and Histology of the Imago by Albert Miller, 7. Collection and Laboratory Culture by Warren P. Spencer.

Each chapter has its own literature list. There is an Index of Names and a Subject Index for the entire book. The work is lavishly illustrated with photographs, photomicrographs, and drawings. Emphasis has been placed on the volume's usefulness as a reference manual. It would seem to be indispensable for those who are working with Drosophila.

EDWARD C. COLIN,
Chicago Teachers College,
Chicago, Illinois

PATTEN, BRADLEY M. *Early Embryology of the Chick.* Blakiston. 244 pp. illus. 1951. $3.50.

This book needs no introduction or review, the three previous editions having made it a standard everywhere that vertebrate embryology is taught. The plan of the book has not been changed, but the pages have been enlarged somewhat and some of the illustrations have been improved by enlargement and better depiction of details. In addition there are many new illustrations. The fine bibliography, characteristic of the previous editions, has been brought up to date. The index has been enlarged somewhat, with the addition of more synonyms and cross references. This book should be available wherever there is interest in vertebrate embryology.

JOHN BREUKELMAN

SCIENCE FILMSTRIPS

PHYSICS
BIOLOGY
MICROBIOLOGY
CHEMISTRY
GENERAL SCIENCE
SAFETY IN THE LABORATORY
ATOMIC BOMB
NATURE'S QUIRKS
HOW TO STUDY
OUTDOOR HEALTH AND SAFETY
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